Remarks

I. Status of claims

Claims 47, 48, 50-55, and 57-66 are pending.

II. Claim rejections under 35 U.S.C. § 102

A. Claims 47 and 54

The Examiner has rejected claims 47 and 54 under 35 U.S.C. § 102(b) over Ramdani (U.S. 5,835,521). In particular, the Examiner has indicated that claims 47 and 54 are anticipated by the alternative embodiment of Ramdani's VCSEL that includes a proton implantation region. In accordance with Ramdani's teaching, the first DBR mirror structure 10 and the active VCSEL device structure 20 are wafer fused together (see col. 5, lines 33-44) and then, instead of etching the contact layer 28, the current spreading layer 31, the cladding region 30, and the active region 34 as shown in FIG. 3, proton implantation is "utilized for current isolation" (see col. 5, lines 50-52). In his rejection, the Examiner has indicated that the proton-implanted region corresponds to the defect source recited in claims 47 and 54 and that the current spreading layer 31 corresponds to the reliability-enhancing layer recited in claims 47 and 54.

Although Ramdani does not explicitly describe how proton implantation is "utilized for current isolation," annular regions of one or more of the contact layer 28, the current spreading layer 31, the cladding region 30, and the active region 34 necessarily must be subjected to proton implantation in order to define a current aperture that achieves the desired current isolation. It is well known in the art that the proton implantation process involves implanting protons (hydrogen ions) beneath the surface of a material. Therefore, contrary to the Examiner's statement, the proton implantation region is not "found to be on top of and next to layer #28." Instead, the proton-implanted region is formed in one or more of the contact layer 28, the current spreading layer 31, the cladding region 30, and the active region 34.

Each of claims 47 and 54 has been amended and now recites that the reliability enhancing layer produces a localized strain field within the defect source. Ramdani does not

even hint that any of the contact layer 28, the current spreading layer 31, and the cladding region 30 produces a localized strain field in the alternative VCSEL embodiment. Without any express teaching that one or more of the layers 28, 31, and 32 produces a localized strain field, one skilled in the art reasonably would assume that the material compositions of these layers are selected to be lattice-matched so that no appreciable strain is produced between the layers (see, e.g., col. 1, lines 36-39 of Ramdani).

For at least these reasons, the Examiner's rejection of claims 47 and 54 under 35 U.S.C. § 102(b) over Ramdani now should be withdrawn.

B. Claims 48, 50, 51, 53, 55, 57, 58, 60, 61, and 63

The Examiner has rejected claims 48, 50, 51, 53, 55, 57, 58, 60, 61, and 63 under 35 U.S.C. § 102(b) over Choquette (U.S. 5,493,577).

1. Claims 48 and 55

Claim 48 has been amended and now recites that the first and second reliability-enhancing layers produce localized strain fields.

In his rejection of claim 48, the Examiner has indicated that the oxidized portion of the aluminum-containing control layer 20 constitutes a defect source and the one or more sub-layers of the control layer 20 that are described in col. 12, line 66 – col. 13, line 19 constitute first and second reliability enhancing layers located on opposite sides of the defect source. In his rejection of claims 50, 51, and 61, the Examiner has stated that these sub-layers inherently produce tensile strain.

In support of his statement that the sub-layers of the control layer 20 inherently produce tensile strain, the Examiner has cited col. 13, lines 8-11 of Choquette's disclosure, which recites:

> In addition, the sub-layers may act to reduce strain effects in the active region due to a slight change in thickness of the annular oxidized portion of the control layer 20 resulting from the chemical change therein due to the formation of an oxide of aluminum. These sub-layers may be, for example, quantum-well layers of AlAs, AlGaAs, GaAs, or the like with thicknesses of about 10 nanometers or more.

This disclosure merely states that these sub-layers reduce strain effects in the active region. As is well known in the art, the relative strain decreases as the distance from a source of strain (e.g., the oxidized control layer 20) increases. The presence of the sub-layers between the oxidized control layer 20 and the active region 18 reduces the strain effects in the active region 18 merely because these sub-layers increase the distance between the control layer 20 and the active region 18.

Contrary to the Examiner's assumption, the cited disclosure does not teach that the sub-layers produce localized strain fields. Indeed, all of the layers in the second mirror stack, including the sub-layers, are selected from the AlGaAs material system, which consists of material compositions that are lattice-matched.[1] As a result, the sub-layers of the control layer 20 do not produce any appreciable strain that reduces defect-induced degradation of the active region by the defect source.

For at least these reasons, the Examiner's rejection of claim 48 under 35 U.S.C. § 102(b) over Choquette should be withdrawn.

Claim 55 recites features that essentially track the pertinent features of claim 48 discussed above and therefore claim 55 is patentable over Choquette for at least the same reasons.

2. Claims 50, 51, 57, 58, 61, and 63

Independent claims 50 and 57 recite that the reliability-enhancing layer is configured to at least in part balance strain created by the defect source.

In his rejection of claims 50 and 57, the Examiner has stated that the sub-layers described in col. 12, line 66 – col. 13, line 19 of Choquette inherently produce tensile strain that offsets the compressive strain produced by the oxidized control layer 20. As explained above in connection with claim 48, however, Choquette does not teach that the sub-layers produce localized strain fields. To the contrary, Choquette teaches that all of the layers in the second mirror stack, including the sub-layers, are selected from the AlGaAs material system, which consists of material compositions that are lattice-matched. As a result, the sub-layers of the control layer 20 do not produce any appreciable strain that reduces defect-induced degradation of the active region by the defect source.

[1] The lattice constant of AlAs is 5.6605 and the lattice constant of GaAs is 5.6533, resulting in a maximum mismatch for the AlGaAs material system of 0.1%.

For at least these reasons, the Examiner's rejection of independent claims 50 and 57 under 35 U.S.C. § 102(b) over Choquette should be withdrawn.

Each of claims 52 and 62 incorporates the features of independent claim 50 and therefore is patentable over Choquette for at least the same reasons.

Each of claims 58 and 63 incorporates the features of independent claim 57 and therefore is patentable over Choquette for at least the same reasons.

3. Claims 53 and 60

Each of independent claims 53 and 60 recites that the reliability-enhancing layer introduces strain that reduces the defect migration introduced by the concentration gradient created by the defect source.

In his rejection of claims 53 and 60, the Examiner has stated that the sub-layers described in col. 12, line 66 – col. 13, line 19 of Choquette inherently produce strain that reduces the defect migration introduced by the concentration gradient created by the oxidized control layer 20. As explained above in connection with claim 48, however, Choquette does not teach that the sub-layers produce localized strain fields. To the contrary, Choquette teaches that all of the layers in the second mirror stack, including the sub-layers, are selected from the AlGaAs material system, which consists of material compositions that are lattice-matched. As a result, the sub-layers of the control layer 20 do not produce any appreciable strain that reduces the defect migration introduced by the concentration gradient created by the defect source.

For at least these reasons, the Examiner's rejection of independent claims 53 and 60 under 35 U.S.C. § 102(b) over Choquette should be withdrawn.

III. Claim rejections under 35 U.S.C. § 103

The Examiner has rejected claims 52 and 59 under 35 U.S.C. § 103(a) over Choquette in view of Shieh (U.S. 5,838,705).

Each of claims 52 and 59 recites that at least one of the first and second mirror stacks comprises oxidized AlGaAs layers, the defect source corresponds to at least one of the

oxidized AlGaAs layers, and the reliability-enhancing layer is formed from $In_xGa_{1-x}P$, wherein $x < 0.5$ tensile.

In his rejection of claims 52 and 59, the Examiner has stated that:

> With respect to claims 52 and 59, Choquette teaches the VCSEL outlined in rejection of claim 50 above, comprising a first mirror stack comprising layers of oxidized AlGaAs (col. 9 lines 11-12), and a reliability enhancing layer which reduces strain and degradation effects in the active region (col. 13 lines 8-11). Choquette does not teach the layer to be made of InxGa1-xP. Shieh teaches a reliability enhancing layer made of lnGaP that reduces strain and degradation effects in the active region (col.3 lines 10-15). Neither source teaches that x should be less than .5 tensile. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the reliability enhancing layer of Choquette with the reliability enhancing layer material type of Shieh as an obvious design choice to fit the material system which is being worked with; in addition it would have been obvious to use x less than .5 tensile as it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 227 F.2d 197, 125 USPQ416 (CCPA 1960).

The Examiner has failed to establish a proper *prima facie* case of obviousness under 35 U.S.C. § 103(a). In particular, the Examiner has failed to provide the requisite factual basis and failed to establish the requisite motivation to support his deemed conclusion that the features recited in claims 52 and 59 would have been obvious to one of ordinary skill in the art at the time of the invention. The Examiner's conclusory assertion that the claimed features of claims 52 and 59 are "an obvious design choice" does not meet the Examiner's obligation to point to some teaching or suggestion in Choquette or Shieh that would have led one of ordinary skill in the art to the invention recited in claims 52 and 59. In this regard, the Examiner is obligated to explain why one skilled in the art would have been motivated to balance the strain created by an oxidized AlGaAs layers with a reliability-enhancing layer that is formed from $In_xGa_{1-x}P$, wherein $x < 0.5$ tensile, when neither Choquette nor Shieh teaches or suggests anything about balancing the strain created by an oxidized AlGaAs layer.

If the Examiner persists with these rejections, he is requested to cite other art in support of his assertions. Alternatively, if the Examiner is aware of facts within his personal knowledge that provide the requisite factual basis and establishes the requisite motivation to support his deemed conclusion that the features recited in claims 52 and 59 would have been

obvious, the Examiner is requested to provide an affidavit in accordance with 37 CFR § 1.104(d)(2). Otherwise, the Examiner's rejection of claims 52 and 59 should be withdrawn for at least this reason.

IV. Claim rejections - double patenting

The Examiner has rejected claims 47, 48, 50-55, and 57-66 under the doctrine of obviousness-type double patenting over claims 1-3, 6, 16-20, 29, 30, 34, and 43-46 of U.S. Patent No. 6,628,694.

The Terminal Disclaimer being filed herewith should overcome this obviousness-type double patenting rejection.

V. Conclusion

For the reasons explained above, all of the pending claims are now in condition for allowance and should be allowed.

Charge any excess fees or apply any credits to Deposit Account No. 50-1078.

Respectfully submitted,

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